UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

E/C.7/1996/4
30 April 1996

ORIGINAL: ENGLISH

COMMITTEE ON NATURAL RESOURCES
Third session
6-17 May 1996
Item 4 (a) of the provisional agenda*

# REVIEW OF PROGRESS ON WATER-RELATED ISSUES

## The state of the freshwater resources of the world

## Report of the Secretary-General

CONTENTS

| | Paragraphs | Page |
|---|---|---|
| INTRODUCTION | 1 - 6 | 2 |
| I. METHODOLOGY OF THE PRESENT ASSESSMENT | 7 - 8 | 3 |
| II. QUANTITATIVE ASSESSMENT OF FRESHWATER RESOURCES | 9 - 11 | 5 |
| III. ECONOMIC IMPLICATIONS OF THE CURRENT SITUATION | 12 - 15 | 8 |

* E/C.7/1996/1.

96-09861 (E) 020596 030596

/...

## INTRODUCTION

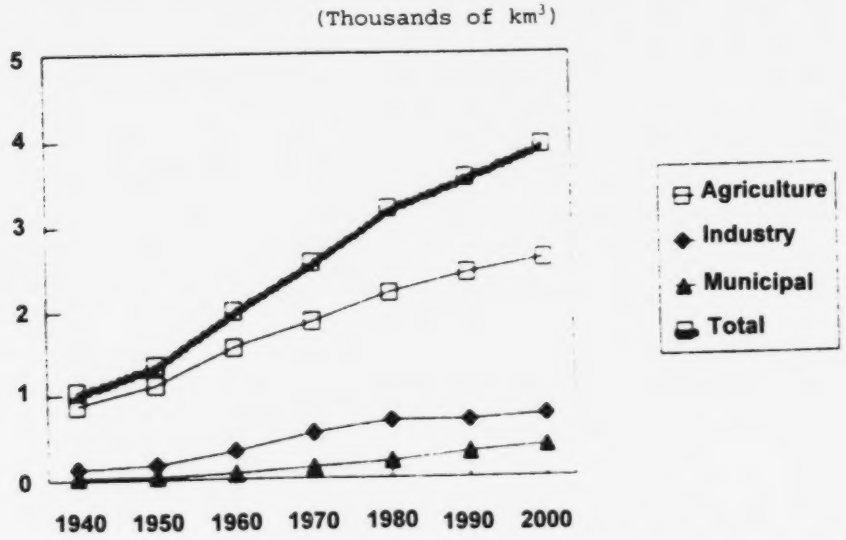
1. At its second session, the Committee on Natural Resources noted with concern the slow pace of progress in the implementation of recommendations of the Mar del Plata Action Plan and Agenda 21. The Committee noted with alarm that some 80 countries, comprising 40 per cent of the world's population, were already suffering from serious water shortages, and that in many cases scarcity of water resources had become the limiting factor to economic and social development, so that ever-increasing water pollution had become a major problem throughout the world, including coastal zones. 1/ At its second session, the Commission on Sustainable Development echoed the concerns of the Committee, noting that in many countries, the rapid deterioration of water quality, serious water shortages and reduced availability of freshwater were severely affecting human health, the ecosystem and economic development. 2/

2. Various factors may contribute to bringing about a water crisis, such as the increasing demand for water brought about by an increasing world population; increased economic activity; wasteful use of water resources; water scarcities arising from financial, technical and institutional constraints; an inability to cope with fluctuations in availability; the degradation of water quality due to human activities; the degradation of land resources as a result of the mismanagement of water resources; and the impact on human health of a lack of access to a safe water-supply and adequate sanitation, and of the inadequate protection of freshwater bodies.

3. World population doubled between 1950 and 1990, from 2.5 billion to 5.3 billion, and is expected to reach 8.3 billion by 2025. Based on the fixed stock of freshwater resources, estimated at some 42,650 cubic kilometres ($km^3$) per year, the annual per capita availability of freshwater worldwide has decreased from 16,930 cubic metres ($m^3$) in 1950 to 8,070 $m^3$ in 1990. By the year 2025, annual per capita availability is expected to diminish further to an average of 5,450 $m^3$. The growth rate of annual freshwater withdrawals between 1950 and 1990 outstripped the rate of population growth: annual freshwater withdrawals increased from 1,365 $km^3$ in 1950 to 3,580 $km^3$ in 1990 (see figure 1). As a percentage of the total availability of renewable water resources, annual withdrawals have increased from 3.20 per cent in 1950 to 8.39 per cent in 1990. 3/

4. Approximately 93 per cent of the increase in population will take place in developing countries, particularly in Asia and Africa, and most of that increase will take place in urban areas. The magnitude of the problem for urban growth in developing countries is illustrated by the fact that while in 1980, 19 of the 30 largest urban agglomerations were located in developing countries, by the year 2000 that total is expected to increase to 22, with each having an estimated population ranging from 6.7 to 22.6 million people.

Figure 1. Global water withdrawals, by sector, 1940-2000




5. The availability of safe water in urban centres is rapidly becoming one of the most important factors limiting socio-economic development. At the same time, increases in population and urbanization will bring with them increases in demand for food production, thus increasing pressures on land and water resources. The Food and Agriculture Organization of the United Nations has estimated that, based on previous trends and modified by land, capital and inputs required to meet future needs, between 1982/1984 and 2000 the area of irrigated land worldwide will grow at a rate of 2.25 per cent per year, and will account for about two thirds of the increase in arable lands over the same period. 4/ The projected rate for developing countries is 2.4 per cent per year. The World Bank estimates that although it will take an average annual growth rate of 2 per cent in agriculture as a whole to feed a world population estimated to reach 6 billion by the year 2000 and 8 billion by the year 2025, the growth rate for irrigated agriculture will have to reach 3 per cent per year.

6. Given the uneven distribution of water resources around the globe, it is clear that water scarcity is not a global problem but a local and regional one. The current report aims to assess the scope and spatial distribution of water scarcities worldwide and their possible consequences for economic development; it also aims to elucidate some possible global consequences of such scarcities.

## I. METHODOLOGY OF THE PRESENT ASSESSMENT

7. Countries are classified as either water surplus, water vulnerable, water stressed or water scarce, based on annual per capita availability of freshwater

resources in cubic metres and annual withdrawals as a percentage of that availability (see table 1). Data was obtained from Professor I. A. Shiklomanov, 3/ the World Resources Institute and the Economic and Social Commission for Western Asia. The definition of categories is based on a matrix shown in table 1, which was agreed upon by the members of a steering committee for the comprehensive assessment of the freshwater resources of the world.

8. The classification described in table 1 has limitations that tend to underestimate the degree of vulnerability, stress or scarcity in any given location. The larger the area for which availability and withdrawal data are given, the more likely that such data will conceal the existence of subregions in which availability is less or water use is greater than reflected in the national average. Thus, countries that are classified as water surplus may well have subregions that are water vulnerable, water stressed or water scarce. Again, since the availability of water resources is given as an annual average, any stresses and scarcities that may arise as a result of seasonal or other fluctuations in such availability will be concealed as well. If fluctuations in availability were taken into account, it is most likely that a number of additional countries would have to be reclassified as water stressed or water scarce. The data in the present report, therefore, should be considered as a first approximation to an assessment of the impact of human-induced activities on the availability of water resources.

Table 1. State of freshwater resources as a function of annual availability and withdrawals

| Annual per capita availability of freshwater resources ($m^3$) | Annual withdrawals as percentage of annual availability | | | |
|---|---|---|---|---|
| | <15 | 15-25 | 25-50 | >50 |
| <500 | Stressed | Stressed | Scarce | Scarce |
| 500-1,000 | Vulnerable | Stressed | Scarce | Scarce |
| 1,000-2,000 | Surplus | Vulnerable | Stressed | Scarce |
| >2,000 | Surplus | Vulnerable | Stressed | Scarce |

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat.

Table 2. Population distribution, by state of water resources of country of residence a/

(Thousands of persons and percentage of global population)

| Annual per capita availability of freshwater resources ($m^3$) | Annual withdrawals as percentage of annual availability | | | | |
|---|---|---|---|---|---|
| | <15 | 15-25 | 25-50 | >50 | Total |
| <500 | 17 509<br>(0.31) | - | 13 328<br>(0.24) | 52 858<br>(0.94) | 83 695<br>(1.48) |
| 500-1,000 | 14 737<br>(0.26) | 2 163<br>(0.04) | 31 538<br>(0.56) | 564<br>(0.01) | 49 002<br>(0.87) |
| 1,000-2,000 | 142 085<br>(2.51) | 1 117<br>(0.02) | 273 548<br>(4.84) | 213 541<br>(3.78) | 630 291<br>(11.16) |
| >2,000 | 1 789 672<br>(31.68) | 1 890 511<br>(33.46) | 1 155 802<br>(20.46) | 50 542<br>(0.89) | 4 886 527<br>(86.49) |
| Total | 1 964 003<br>(34.76) | 1 893 791<br>(33.52) | 1 474 216<br>(26.09) | 317 505<br>(5.62) | 5 649 515<br>(100) |

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat.

Note: A hyphen (-) indicates that none of the population surveyed falls into this category.

a/ See table 1.

## II. QUANTITATIVE ASSESSMENT OF FRESHWATER RESOURCES

9. Table 2 shows the distribution of the population worldwide among the categories defined in table 1 for the countries for which sufficiently reliable data were available. The available sample included 98.83 per cent of the total world population. Globally, 1.93 billion people (34.2 per cent of the world population sampled) live in water surplus countries; 1.91 billion (33.7 per cent) in water vulnerable countries; 1.5 billion (26 per cent) in water stressed countries; and 362.4 million (6 per cent) in water scarce countries. Thus, 32 per cent of the world population live in water stressed or water scarce countries; if to these are added the population of water vulnerable countries, then 65.8 per cent of the world population live in countries in which the allocation of water resources must be carefully considered.

10. The problems faced by water scarce, water stressed and water vulnerable countries often result from the intensive use of water as much as - if not more than - from low availability. Thus, about 75 per cent of the population of water scarce countries live in countries with an annual per capita availability of freshwater resources of 1,000 $m^3$ or more (about 60 per cent in the 1,000 to 2,000 $m^3$ range and about 15 per cent in the 2,000 $m^3$ and greater range). On

the other hand, almost 90 per cent of the population of water scarce countries live in countries that use more than 50 per cent of available resources, while the remaining 10 per cent or so live in countries that use 25 to 50 per cent of available resources. As to the water stressed countries, about 80 per cent of their population live in countries with a per capita availability greater than 2,000 $m^3$ and about 20 per cent in countries with a per capita availability of 1,000 to 2,000 $m^3$, while almost 99 per cent live in countries that use 25 to 50 per cent of available resources. As to the water vulnerable countries, 99 per cent of their population live in countries with a per capita availability greater than 2,000 $m^3$, and about the same percentage live in countries that use 15 to 25 per cent of available resources. In sum, although some 85 per cent of the world population live in countries with an annual per capita availability of freshwater resources of greater than 2,000 $m^3$, about 25 per cent of these live in countries that use 25 to 50 per cent of available resources and about 40 per cent in countries that use 15 to 25 per cent of available resources. And of the 11 per cent of the population who live in countries with a per capita availability of 1,000 to 2,000 $m^3$, some 80 per cent live in countries that use 25 per cent or more of available resources. Finally, of most particular concern are the 6.4 per cent of the world population who live in water scarce countries.

11. The regional and subregional distribution of the population of water scarce, water stressed and water vulnerable countries is shown in table 3. With increased population and economic activity, there is no doubt that additional countries will become water vulnerable, water stressed or water scarce. Moreover, the condition of countries already in any of those three categories will be exacerbated unless measures are taken to decrease the intensity of their water use. A number of countries in Asia and in Africa, particularly countries in which annual per capita availability is already as low as 1,000 to 2,000 $m^3$, will be most susceptible to pressures on their water resources.

Table 3. Regional and subregional distribution of the population of water vulnerable, water stressed and water scarce countries

| Region/subregion | Percentage of population resident in | | |
|---|---|---|---|
| | Water vulnerable countries | Water stressed countries | Water scarce countries |
| Americas | 47.49 | | |
| North America | 89.90 | | |
| Mexico and Central America | 74.10 | | |
| Caribbean | 30.81 | | |
| | 2.18 | 9.41 | 14.45 |
| Africa | | | |
| Northern Africa | | 16.83 | 65.49 |
| East Africa | 6.81 | | |
| West Africa | 0.19 | | |
| Middle Africa | | | |
| Southern Africa | | 87.49 | |
| | 41.47 | 32.17 | 7.02 |
| Asia | | | |
| East Asia | 96.23 | 3.16 | |
| South-Central Asia | 0.34 | 74.16 | 1.28 |
| Western Asia | | 23.92 | 35.14 |
| | 12.18 | 36.89 | 2.00 |
| Europe | | | |
| Eastern Europe | | 29.08 | 1.44 |
| Northern Europe | 5.59 | | |
| Southern Europe | 6.83 | 67.26 | |
| Western Europe | 40.64 | 45.12 | |

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat.

Note: Figures indicate percentage of population in each region/subregion that live in countries in each category; a blank indicates that no country surveyed in that particular region/subregion falls into that category.

## III. ECONOMIC IMPLICATIONS OF THE CURRENT SITUATION

12. Table 4 shows the distribution of population by income group for countries classified as water surplus, water vulnerable, water stressed or water scarce. The table shows that about 60 per cent of the world population belongs to the low-income category and about 76 per cent to low and low-medium income categories combined. The data also shows that 80 per cent of the population of water stressed and water scarce countries belong to the low or low-medium income group, along with 70 per cent of the population of water vulnerable countries. One third of the world population with low or low-medium incomes live in water stressed or water scarce countries. Given the rapid rate of population growth in developing countries, it is likely that the proportion of the poorer countries that are classified as water stressed or water scarce countries will increase.

Table 4. Population distribution, by water-supply conditions and income group

(Thousands of persons)

| Water-supply conditions | Per capita income (United States dollars) | | | | Total |
|---|---|---|---|---|---|
| | Low (<$695) | Low-medium ($695-$2,785) | Medium ($2,786-$8,626) | High (>$8,626) | |
| Surplus | 987 032 | 526 950 | 227 084 | 190 691 | 1 931 757 |
| Vulnerable | 1 259 724 | 79 785 | 105 027 | 461 839 | 1 906 365 |
| Stressed | 938 753 | 194 132 | 67 607 | 248 530 | 1 449 022 |
| Scarce | 191 735 | 127 041 | 23 851 | 19 744 | 362 371 |
| Total | 3 377 244 | 927 908 | 423 569 | 920 794 | 5 649 515 |

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat.

13. The current situation has serious implications for the patterns of economic growth and food security in several regions of the world. Water may well become a limiting factor for many of the poorer countries in Asia and some parts of Africa. As the demand for water for urban and industrial purposes grows, water for agriculture will become increasingly scarce. China, which is currently classified as water vulnerable, could become water stressed in the next 30 years; India, which is currently classified as water stressed, could become water scarce within the same period. Many developing countries in the water stressed or water scarce categories have withdrawal to availability ratios that are already considered to be unsustainable. As mentioned earlier, an additional number of low-income countries are also likely to be effectively water stressed or water scarce as a result of fluctuations in the availability of water.

14. Managing the problem of the increasing scarcity of water will need to combine concern for economic efficiency with concern for social equity. One approach might be to establish regimes for allowing the prices that water users pay to adjust gradually so as to more closely reflect the scarcity value, at least for withdrawals above the minimum needed by households for health. This would allow markets to reallocate water from agricultural and industrial uses with low value-added per input of water to uses with high value-added, such as specialty crops and industrial processes that use relatively little water; in some cases, it might lead to countries approaching nearly complete economic specialization in non-agricultural production.

15. There was no correlation found between annual per capita withdrawals of water and annual per capita income: there are high-income countries with low annual per capita withdrawals, and low-income countries with high annual per capita withdrawals.

## Notes

1/ Report of the second session of the Committee on Natural Resources, New York, 22 February-4 March 1994 (E/1994/26), paras. 1 and 2.

2/ Report of the second session of the Commission on Sustainable Development, New York, 16-27 May 1994 (E/1994/33/Rev.1), para. 133.

3/ See I. A. Shiklomanov, "Assessment of water resources and water availability of the world", Scientific and Technical Report (Saint Petersburg: State Hydrological Institute, February 1996).

4/ International Irrigation Management Institute, "Developing environmentally sound and lasting improvements in irrigation management", paper submitted to the International Conference on Water and Environment (Dublin, 26-31 January 1992).

---

# E/C.7/1996/5

Readex
Fiche

UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

E/C.7/1996/5
3 April 1996

ORIGINAL: ENGLISH

COMMITTEE ON NATURAL RESOURCES
Third session
6-17 May 1996
Item 5 of the provisional agenda*

# REVIEW OF IMPLEMENTATION PLANS FOR AVERTING THE FRESHWATER CRISIS

## Preparation of implementation plans for averting the freshwater crisis

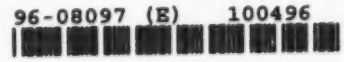
## Report of the Secretary-General

CONTENTS


| | | Paragraphs | Page |
|---|---|---|---|
| I. | BACKGROUND | 1 - 2 | 2 |
| II. | DECISIONS OF THE COMMISSION ON SUSTAINABLE DEVELOPMENT AT ITS SECOND SESSION | 3 - 5 | 2 |
| III. | REVIEW OF ACTIONS TAKEN IN THE IMPLEMENTATION OF A FRESHWATER ASSESSMENT | 6 - 10 | 3 |


* E/C.7/1996/1.

96-08097 (E) 100496



/...

## I. BACKGROUND

1. In decision 2/1, adopted at its second session, in 1994, the Committee on Natural Resources noted with concern the slow pace of progress with regard to the implementation of the recommendations of the Mar del Plata Action Plan and Agenda 21; it noted with alarm that some 80 countries, comprising 40 per cent of the world's population, were already suffering from serious water shortages and that, in many cases, scarcity of water resources had become the limiting factor to economic and social development; and it also noted that ever-increasing water pollution had become a major problem throughout the world, including coastal zones. 1/

2. In view of these considerations, the Committee, also in decision 2/1, recommended that the Commission on Sustainable Development, at its second session, in 1994, affirm the vital importance of establishing a global implementation plan to avert the impending water crisis, incorporating principles for the effective management of land and water resources and guidelines and schedules based on Agenda 21; it also recommended that the Commission on Sustainable Development support the formulation of such an implementation plan to be reviewed by the Committee on Natural Resources in 1996; and it further recommended that the Commission approve the formulation of the plan by the Working Group on Water of the Committee on Natural Resources jointly with the Subcommittee on Water Resources of the Administrative Committee on Coordination, drawing upon the results of the regional meetings of the United Nations Environment Programme already scheduled to address the issue and other relevant activities of the organizations and specialized agencies of the United Nations. 1/

## II. DECISIONS OF THE COMMISSION ON SUSTAINABLE DEVELOPMENT AT ITS SECOND SESSION

3. At its second session, in 1994, the Commission on Sustainable Development noted with great concern that many countries were facing a water crisis, with rapid deterioration of water quality, serious water shortages and reduced availability of freshwater, which severely affected human health, the ecosystem and economic development. 2/

4. The Commission, however, did not act on the Committee's recommendation concerning the formulation of an implementation plan to avert a freshwater crisis. Rather, it urged the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO), the World Health Organization (WHO), the World Meteorological Organization (WMO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), in collaboration with the United Nations Development Programme (UNDP), the World Bank and other relevant United Nations bodies, as well as non-governmental organizations, to strengthen their efforts towards a comprehensive assessment of freshwater resources, with the aim of identifying the availability of such resources, making projections of future needs, and identifying problems to be considered by the General Assembly at its special session in 1997. 3/

5. The Commission invited Governments to cooperate actively with technical inputs to the process, taking into account the need for support for the full participation of developing countries, and welcomed the offer of the Government of Sweden to contribute by preparing a preliminary assessment of freshwater. The Commission recommended that the Economic and Social Council invite the Committee on Natural Resources to address the question of freshwater resources as part of the comprehensive assessment at its third session in 1996. The Commission decided to review, at its 1997 session, the result of all the work outlined above. 4/

## III. REVIEW OF ACTIONS TAKEN IN THE IMPLEMENTATION OF A FRESHWATER ASSESSMENT

6. The implementation of the assessment is being carried out through a Steering Committee composed of organizations of the United Nations system and the Stockholm Environment Institute, which was commissioned by the Government of Sweden to collaborate on its behalf in the preparation of the assessment. At its fifteenth session (September 1994), the Subcommittee on Water Resources of the Administrative Committee on Coordination appointed the Department for Policy Coordination and Sustainable Development, the Department for Development Support and Management Services, UNEP, UNDP, FAO, UNESCO, WHO, the World Bank, WMO and UNIDO to represent the organizations of the United Nations system in the Steering Committee. In addition to the support given by the Government of Sweden through the Stockholm Environment Institute, financial and technical support has been provided by the Governments of Canada, Denmark, the Netherlands and Norway. So far, five meetings of the Steering Committee have taken place, the latest on 14 and 15 March 1996.

7. As envisaged by the Steering Committee, the report to be submitted to the Commission on Sustainable Development and to the General Assembly in 1997 will consist of four sections, supplemented by background documents containing an in-depth discussion of the issues discussed in each section. The introductory section of the report will provide a rationale for the assessment, outlining the concerns that led to the assessment in terms of increasing demands for competing uses, the stresses on the resource as result of increasing pollution, the impact and effects of inappropriate land and water management practices on the flow and quality of water and on land degradation, the need to manage environmental impacts of water resources development and use, the need to bring about cooperative approaches to the development of shared water resources, and the need to ensure that water resources development and management policies address the issue of poverty alleviation. The second section of the report will address global issues related to the availability, variability and quality of water and the stress on the resource brought about by its use. The section will endeavour to provide an assessment of the current situation concerning water availability and use in the context of the hydrological cycle. Driving forces, such as population dynamics and consumption patterns, will be discussed. Two meetings of an expert group were convened by WMO and UNESCO acting as lead agencies. The purpose of the expert group was to access and review the best available data and ensure its reliability. Data concerning agricultural, industrial and municipal uses have been provided by FAO, UNIDO and the United Nations Centre for Human Settlements (Habitat). Information concerning water quality is being obtained

from UNEP and WHO through the Global Environment Monitoring System (GEMS) water programme.

8. The third section of the report, which is being prepared with the Stockholm Environment Institute acting as lead agency on behalf of the Steering Committee, will utilize a number of scenarios with a time horizon to the year 2025 in order to investigate the likely effect of trends and policies in search of a sustainability path. These scenarios will seek to display variations between different regions of the world and will include an analysis of selected river basins with a view to identifying priority areas for action.

9. The final section of the report will present a set of policy options for the long-term sustainable development and utilization of water resources, based primarily on the analysis carried out in the previous sections. These policy options will endeavour to link land and water management issues; water for food security; and safe drinking water supply, sanitation and sewerage and human health in the context of economic and social development.

10. The report will be supplemented by commissioned studies on the economic aspects of sustainable water resources development and use and gender issues, as well as a study on the relationship between water resources and growing urbanization and a study on cooperative approaches to the development of shared river basins.

## Notes

1/ Official Records of the Economic and Social Council, 1994, Supplement No. 6 and corrigendum (E/1994/26 and Corr.1), chap. I, sect. C.

2/ Ibid., Supplement No. 13 (E/1994/33/Rev.1), chap. I, para. 133.

3/ Ibid., chap. I, para. 148.

4/ Ibid., chap. I, paras. 149-151.

---